

About the author.

Ted Nelson, a "top-down idealist," has been designing interactive systems for personal computers since 1960. Most of his writings are about one set of ideas, now implemented as the Xanadutm Hypertext System, a storage module soon to be available for over-the-phone experimentation. It is further explained in his book Literary Machines (available from Project Xanadu, 8480 Fredericksburg, Suite 138, San Antonio TX 78229, for \$15).

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THE TYRANNY OF THE FILE

Theodor H. Nelson

The fish does not see the water. And we computer people, even the savants and whizzes and frontiersmen, generally fail to see the most oppressive and devastating aspect of our working lives. I refer to the FILE. And the conceptual structure of the storage methods we must deal with. Chaotic and conceptually fragmented, the world of computer files is an enormous barrier to the clean systems of tomorrow.

We tell beginners it MUST BE THIS WAY. But I believe there has to be a fundamental redesign of the way we use computers, making this bar-

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cathedral (Klosterkirche) is old and small and is
now a side church.

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the way we use computers, offering this new
and difficulty. A clean new interface to our
worlds of information could sweep away a vast
amount of the difficulty that people have with
computers.

Indeed, what the world needs is a generalized
form of storage that will grow and adapt and
hold data for every type of application; that
may be shared among all applications, yet which
does not slant or gerrymander that data in any
particular way, but creates a common and
clarifying and universal system of storage.

THE SYSTEM OF FILES

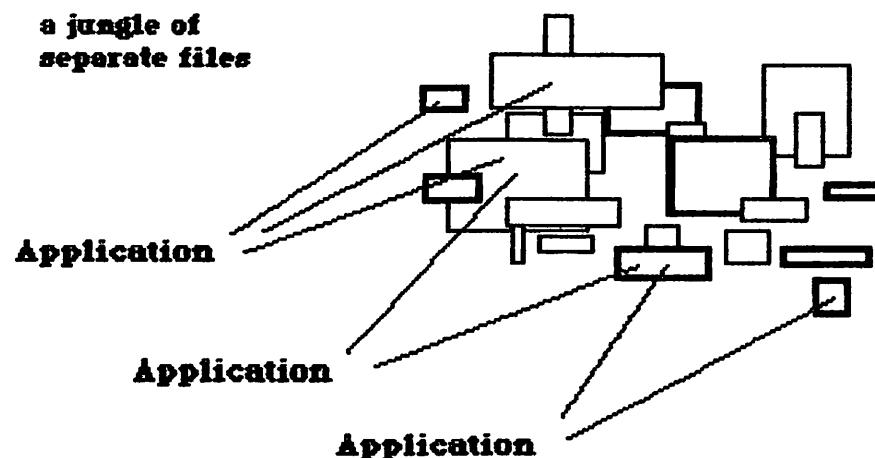
Computer use is principally concerned with
maintaining order in a chaotic jumble of files
that grows ever worse.

Some files stand alone, some must be managed in
clusters; but typically they are all piled
together on disk with archival copies and
backups in an ever-more-confusing tangle.

This is SEEZNOW.d9

WHAT THE USER SEES NOW:

a jungle of
separate files



INFERNAL COMPLICATIONS

Having to keep track of files is an endlessly
complex and exasperating chore that may best be
compared to herding mice. You have to keep
pouring them from medium to medium. You have to keep
name them all; you have to rename them; you have
to keep keeping copies; you have to move them by
copying and then deleting one of the survivors.
(Making sure to delete the correct file in a
jungle of similar names is roughly like holding

But the odyssey of a seven billion dollar team baseball
line requires the many little test segments to make
sense and it requires the equity structure not just afford
the team the potential for success. The primary benefit of a team
was in the team itself recognizing no transaction would
be normal if between the new ownership the
legends had to make way for the new partners.

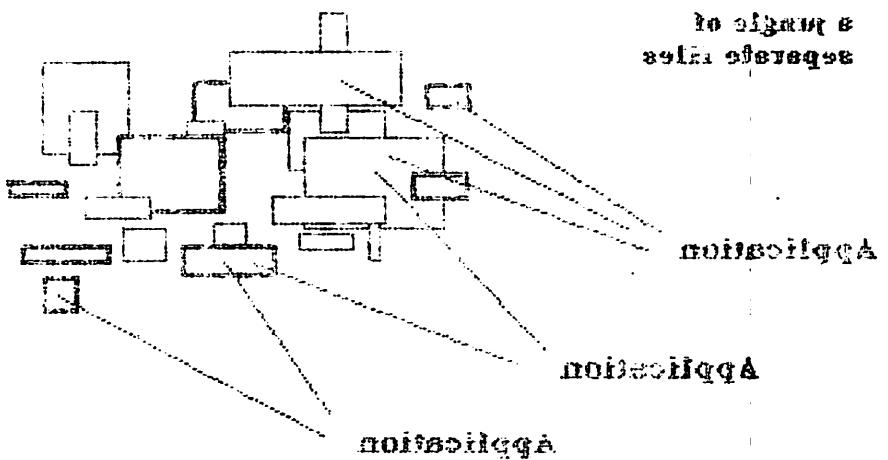
33119 70 MARYS 347

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to sign a
series of notes



INEBRIER COUNTY, W. Va.

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your baby and your garbage over the incinerator and letting go of one, ten times a day.) Then there are the endless problems of backups, of finding space for them (often in dark crannies of disk), the escalating annoyance as disk volumes get filled to capacity and emergency transfers and deletions must be made.

Typically, from time to time, somebody just throws it all away and starts afresh, or just puts a big mess away in storage somewhere and starts over, or does a sweeping reorganization that also loses a great deal of data.

The older material can be found with difficulty as long as certain employees are still around.

THE HIERARCHY OF FILES: CATALOGS AND DIRECTORIES

Hierarchical file structures originally seemed an improvement because they gave you more places to put things, and because they had a certain fit to some applications.

Some people think hierarchically, and that's fine; but those who don't shouldn't be forced into it. (There are those who imagine that forcing your problem into a hierarchical structure promotes clear and rigorous thinking. This is, to use the politeest possible term, malarkey; mapping any set of ideas to any other may present interesting exercises to the mind, but there is little point if they don't fit well.)

But unfortunately the hierarchical file model requires intricate fixed pathways we must commit to and memorize, and are very hard to change.

Yet the way we think of our work is constantly changing at the highest level. (Lucky is he whose ideas are fixed and unchanging.) Unfortunately, existing file methods stick us forever with the groupings that we start with--whatever divisions and hierarchies seemed appropriate at the beginning-- unless we do elaborate reorganizations that nobody has time for.

RELATIONS BETWEEN MATERIALS: HOW EASILY LOST

Many things need to be divided into separate files though they are connected; but the connections, not being represented, tend to evaporate. Cross-references between them; the interconnections of shared material; commonality and parallels; all these become easily lost because not easily represented.

There are many areas where we build ad-hoc programs to cope with what's not built into the

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As long as chemists continue to use the older methods, they will be forced into a dead end.

THE HIGHLIGHTS OF 1973: CATALOGUE AND INDEX

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mestig a bed kett aenoufde bns regnig: fug of
aenoufde liggas emos of efft

Some people think pink is the best color for a baby's room, but others prefer blue or green. The most popular colors for boys' rooms are blue, green, and yellow. For girls' rooms, pink, purple, and yellow are the most popular colors. Some people like to use a combination of colors, such as blue and white or pink and white. The most important thing is to choose colors that you and your child like.

Second, it is recommended that the *International Convention on the Protection of the Rights of All Migrant Workers and their Families* be adopted at the earliest possible date.

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Believe in this art is regarded as the
most important art of all arts.

REFACTION BETWEEN HIGH ENERGY RADIATION

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,bēbennqenq xilis ton ,bēbennqenq

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storage system. Programs for intercomparison of files; indexing programs that mark points in text; delta-list programs to manage the history of changes; "software configuration management," which are systems for putting out different versions of the same programs from a common library. These are just a few. But I insist that if we had proper storage, all these functions would be handled in the data structure as a common reference system, available to all software.

FORMALITIES OF OPENING AND CLOSING

At the user level, most software affronts the user with tedious formalities of opening and closing that are based on this file model. Since files, their names and versions constitute the surface structure of this universe, selecting and opening these files is a level of annoyance that make firing up an application like opening a bank account. Such unnecessary distraction and formalism forbid inspiration grabbing, wear you out before you even start. This is comparable to having to deal with a desk clerk in order to make love.

(Things like Sidekick permit this to some extent, but the elaborate formalities are still necessary to put the stuff away when it's done.)

We should be able to work on numerous things at once, ping-pong style, without having to deal consciously with the formalisms of opening and closing them.

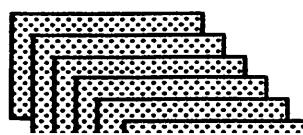
Many would say you could do this by conventional methods, and today's windowing packages are a start, but these are just a disguise over the existing file methods, which must be grappled with as usual when the day is done.

SUBTLER PROBLEMS

Moreover, I would argue that the conventions of files as we know them put pressure on software design to take certain oversimplified forms.

For instance, we are familiar with the "database model," in which separately coded items, or "records," may be searched on various criteria;

This is DBMODEL.DB



PROBLEMS FOR INVESTIGATION. Problems for investigation are those which point to the cause of death, either by direct or indirect evidence. These problems are usually of two kinds: (1) those which point to the cause of death, and (2) those which point to the cause of death, but do not point to the cause of death.

PROBLEMS OF DISEASE AND CRIME

Problems of disease and crime are those which point to the cause of death, and those which point to the cause of death, but do not point to the cause of death.

Problems of disease and crime are those which point to the cause of death, and those which point to the cause of death, but do not point to the cause of death.

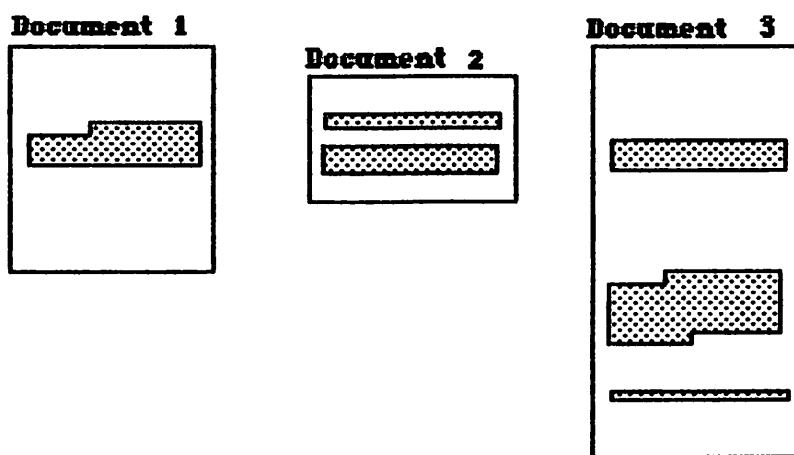
Problems of disease and crime are those which point to the cause of death, and those which point to the cause of death.

SUSPECT PROBLEMS

Problems of suspect are those which point to the cause of death, and those which point to the cause of death.

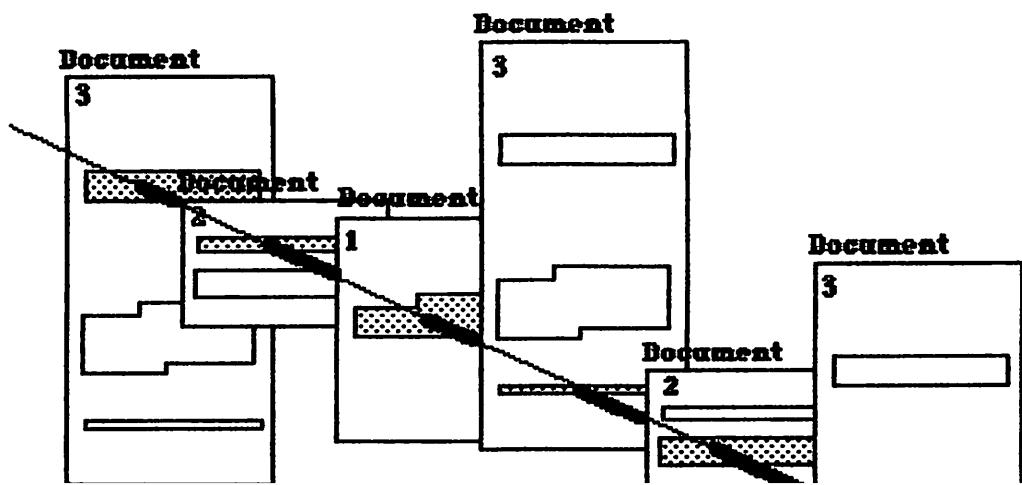
we are also familiar with the "word processing model," where sequential text may be scanned, revised and printed. But why can't these approaches be combined? What if you want to code sections of text inside their documents? But today's software doesn't let you do this. (A partial exception is a program called Dayflo.)

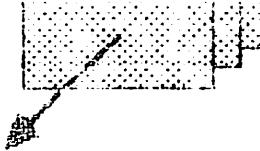
This is WPMODEL.D8



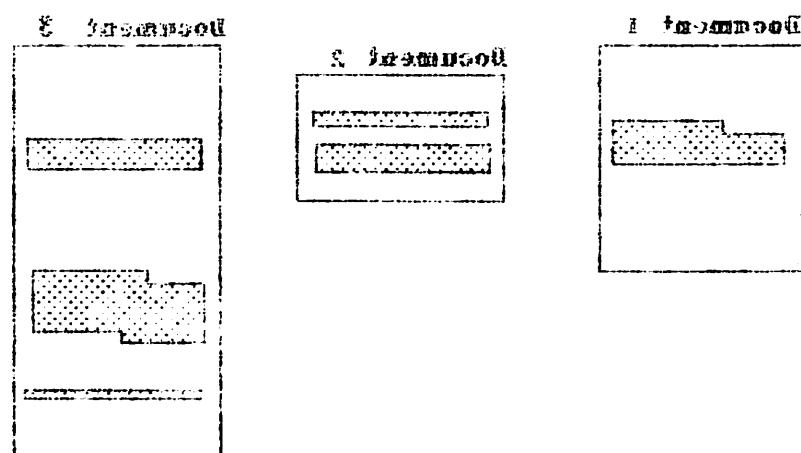
You might also like to search for the coded pieces and sort them like database items, yet see them in their living contexts at the same time.

This is THECOMBO.D8



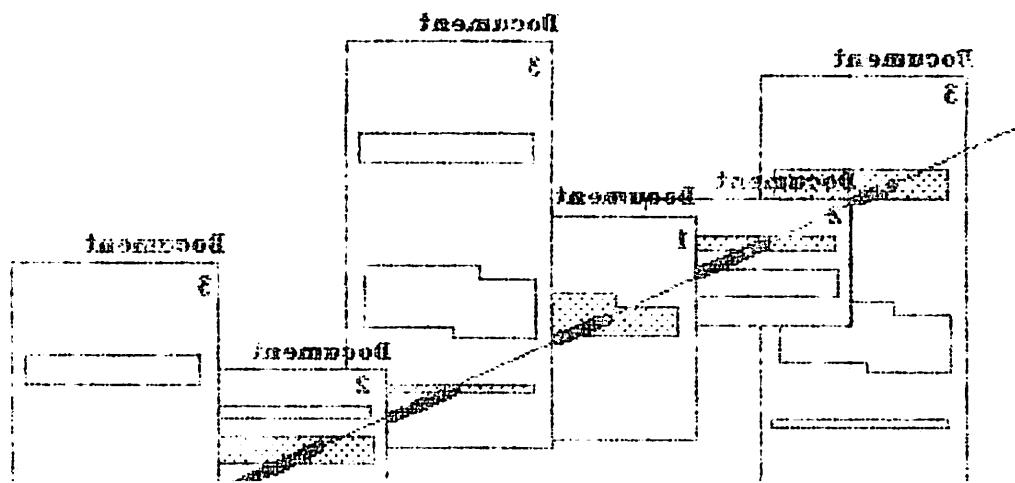


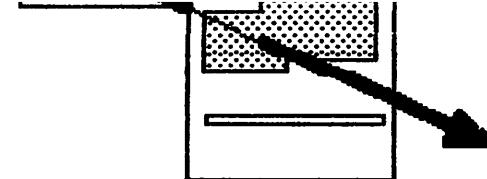
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While of course these things are "possible to program," the conventions of files strongly pressure the programmer to oversimplify both the data and the uses of the data.

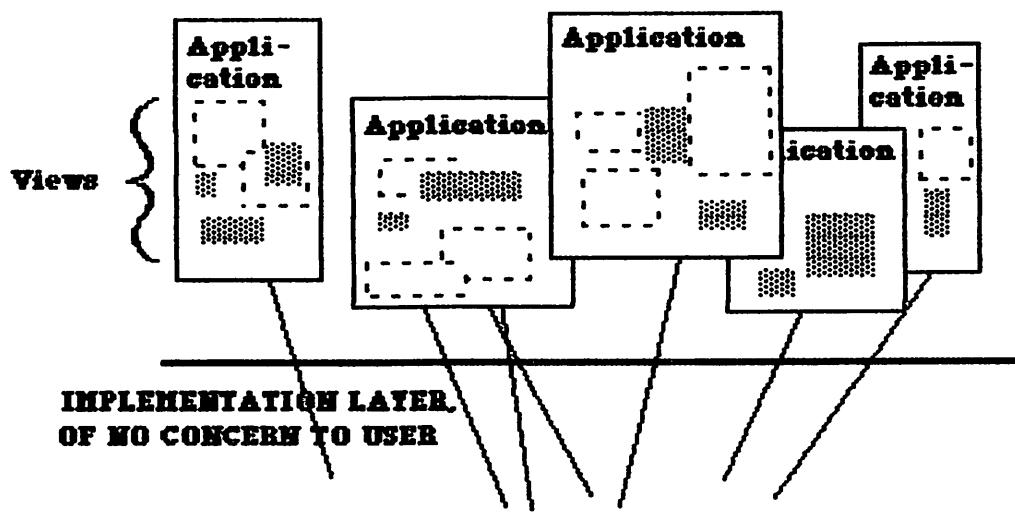
ENVISIONING A WORLD WITHOUT FILES

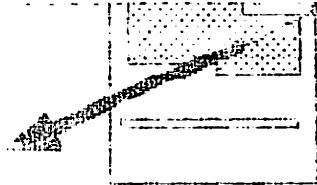
By a world without files, I mean a world where the user will see his or her latest work in its preferred appearance, and be able easily to trace interconnections and intercompare versions.

Each application should be like a door to a world; the user opens doors into applications, with multiple views of materials, each a different context or way of working on it. We need multiple pathways to the same material at the user level. Whole environments and surroundings should be easily snapshot and reopened. (This has been the intent of many integrated-software packages, notably Symphony, which tried to make possible many different views of common materials.)

This is SHUDSEE.d9

WHAT THE USER SHOULD SEE: APPLICATIONS AND VISUALIZATIONS-- different contexts for the same materials





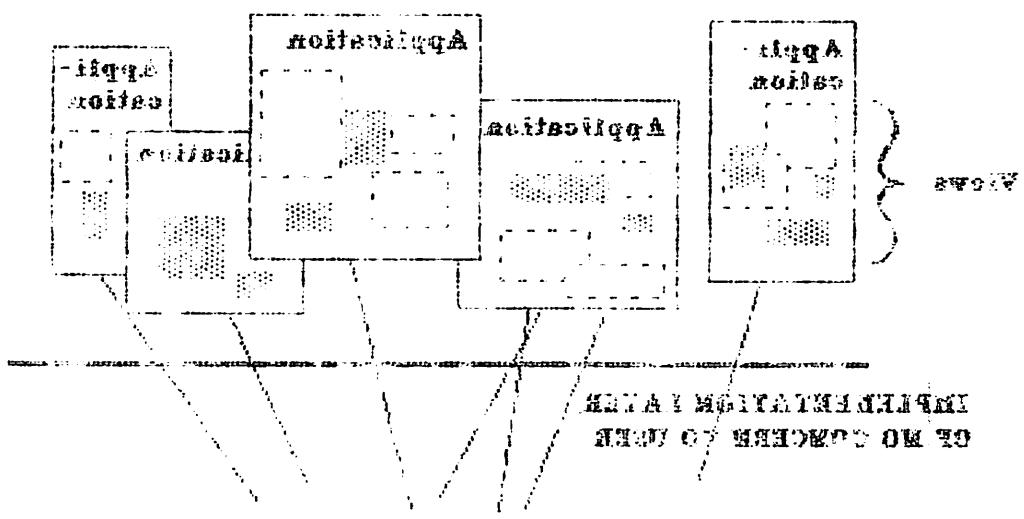
ENTERTAINMENT & MOBILE MERCHANT LIFE

I know a poem I rec'd from a friend a few weeks ago
I know feels i had no idea it was this poem until
I read it. This is the poem I rec'd from a friend a few weeks ago

As of now is expected blood clotting cascade
 , which will only stop any bleeding and it is
 able to return to new equilibrium after
 it is gone. It is not possible to stop clotting cascade
 as clotting cascade can only stop bleeding after it has
 been eliminated. Level of blood clotting
 can decrease unless a clotting cascade
 is used to return and this needs a clotting cascade
 to stop bleeding. This is because
 clotting cascade is able to make blood clotting
 faster and it is a normal process of the body.

45,325,000 in 1913

APPLIED INNOVATIONS TWO AND THREE
GIVES YOU THE SAME INNOVATIVE
APPLICATIONS FOR THE SAME PROJECTS



GRADUAL SEPARATION OF VERSIONS

The same things have been worked on in many different contexts, sometimes growing apart in different ways.

It should be possible gradually to change and separate different versions, yet keep their commonalities traced. This does not exist in any well-known system.

THE ALTERNATIVE

What I am proposing requires a different approach to storage. Let me explain this by degrees, starting with the case of text storage, and expand the idea toward a generalized structure.

We called the old units "files;" let us choose a new name for units that can link and overlap. I propose that we use the term "document," since text documents are often interconnected in the way we plan to permit.

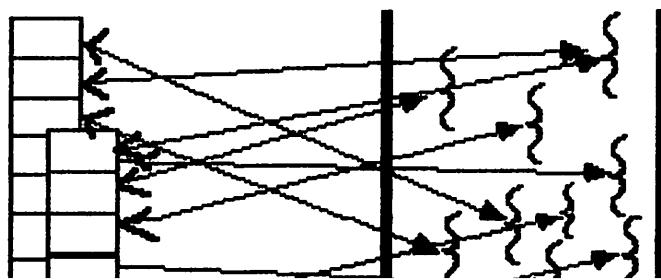
The purpose is the same as that of a file-- a useful collection of data-- but with new advantages.

Let us begin by collecting all text into a pool of dated bytes. Each byte knows when it was created. A document is a list of pointers into this pool. Conversely, each byte knows what pointers there are to it from where in which documents. (This is related to the "piece table" approach of such word processors as Samna.)

This is DOX&POOL.D8

DOCUMENTS

TEXT POOL



... *discreetly*
believe me to be
quite tired of the

БИБЛІОГРАФІЧНА ІНФОРМАЦІЯ

The same principles may be applied to many different contexts, some of which are described in the following sections.

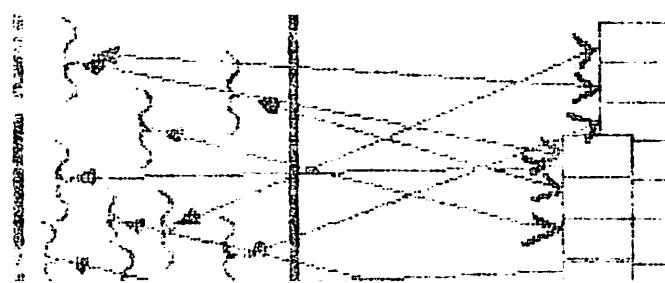
ЭУЛТАНГЭТ НА ЭНТ

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Different documents may point into the same text pool, using the same materials in different ways. As they are modified they depart from one another, and their pointer lists change.

Given this data structure, it is plain how it may be implemented for a variety of different functions--

- to go to an arbitrary part of any document;
- to find what documents use a given string or byte, and where it falls in each;
- to find out whether two specific documents share a piece of text;
- to see the same text as it appears in two different documents;
- etc.

While this has certain unusual speed advantages-- it also allows rapid jumps to arbitrary positions in text, since the program steps through pointers instead of text-- this is not its real power.

This permits a user to re-use and rework the same materials repeatedly in different ways and for different purposes, unconfused as to their origin and able to find out which sections are common between what documents and versions.

Multiple documents and users may share material, without redundant storage.

This is especially useful for "boilerplate" applications, where the same materials are reworked for different purposes.

**FOR A SINGLE USER:
GREATER SPEED AND CLARITY**

CLARIFICATION OF WHAT THINGS ARE
AND THEIR INTERRELATION--
NOT LIKE "FILES"

Even for one user, this approach brings clarification. The parallel maintenance of different versions, the continuing connections to the origins of each part, and differences between all working versions are easy to keep track of. Note also that the storage overhead from maintaining many documents (and saving back versions) is reduced in proportion to the amount of overlapping material.

FOR SHARED USE



Even when a single point in the system is changed, the entire system is affected. This is because every point in the system is connected to every other point, forming a complex web of interdependence.

For example, if a single component fails, it can affect the entire system. This is because the system is highly interconnected, and a failure in one part can easily spread to other parts. This is why it is important to understand the complex web of interdependence in a system.

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FOR A SINGLE USER,
GREATER SPEED AND DURABILITY

CHARACTERISTICS OF WHAT THINGS ARE
AND THEIR INTERRELATION -
NOT LIKE "FILE"

Even though there is a single point of failure, the entire system is interconnected. This means that a failure in one part can easily spread to other parts, causing the entire system to fail. This is because the system is highly interconnected, and a failure in one part can easily spread to other parts. This is why it is important to understand the complex web of interdependence in a system.

The payoff can be even greater in a file server for many users who are sharing material. The data stay in place, they may participate in many documents of different kinds, and each use may evolve separately-- but connections may be continually traced among them. Where the same materials and boilerplate are repeatedly used, as in law offices, such facilities can be vital.

9

FORMATTING

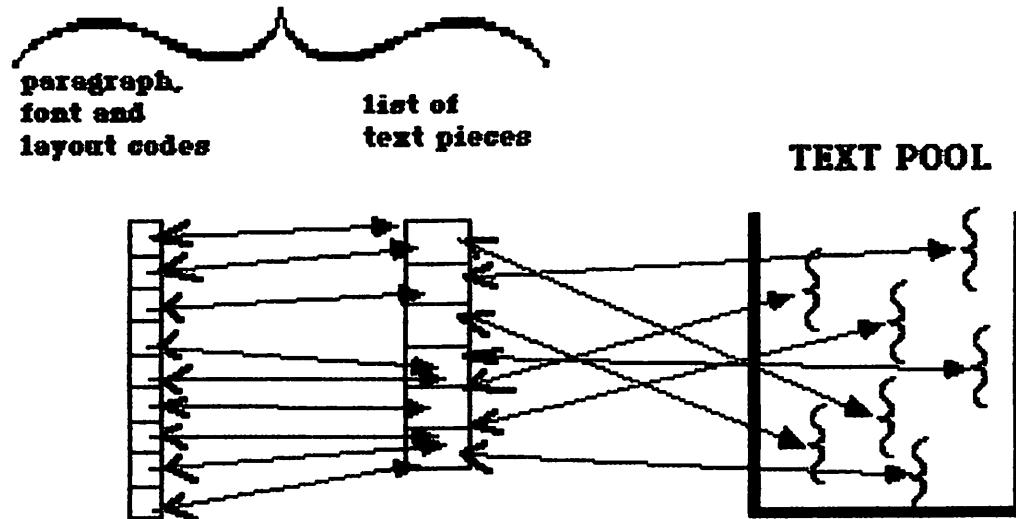
The text pool should contain only "pure text," uncluttered with information about paragraphs, fonts, etc., that will be different among different users. Thus formatting information must be purged from the text, in order to assure that only a clean base of sharable materials be in the common pool.

Therefore a second set of pointers is needed, isolating the formatting information.

Formats are now sets of pointers into this pool, with separate format codes.

This is FORMATNG.D8

DOCUMENT



6

GENERALIZING TO ALL FORMS OF DATA

This same approach may be deeply generalized. What we have found is a way to mark the data from outside, so that these applications which want to share the data and the markers may do so freely, but the markers do not clutter the data for applications where they're not wanted.

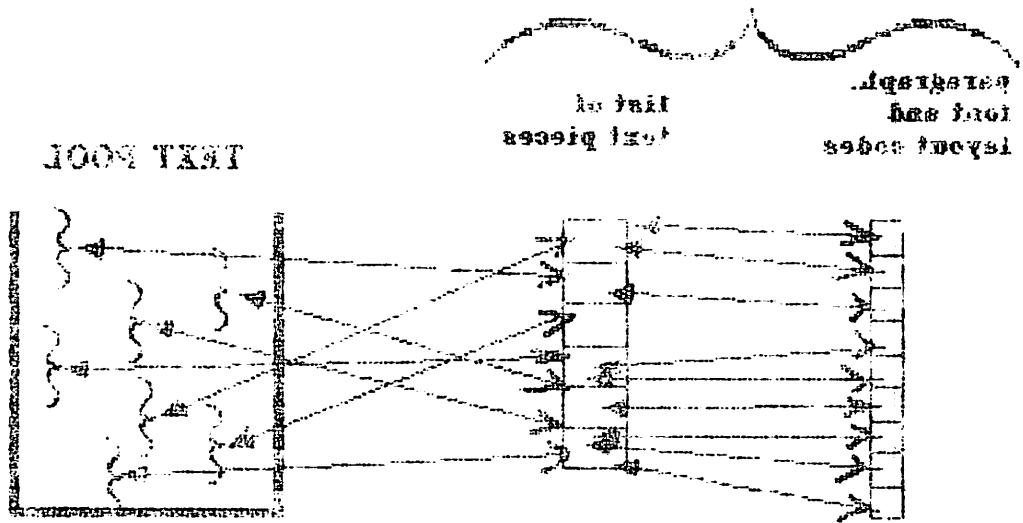
We really want a much more general facility, one which permits arbitrary markings in a pool of data which may be used for different purposes by

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DOCUMENT



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stab. sif. Nam et. *ex parte* tamen et. *ex parte* tamen
alii non sententia regis senti facta est. *ab initio* moni-
te ab rem aeternam et. *ex parte* sif. et. *ex parte* et. *ex parte*
stab. sif. *ex parte* non ab aeternam et. *ex parte* et. *ex parte*
absentia non et. *ex parte* sif. *ex parte* et. *ex parte* non

the best way to help more people learn English fast and free.

data which may be used for different purposes by different users of these data, but which do not obstruct or encumber the data for users who don't want them.

10

We may think of this as a generalization of this format coding system.

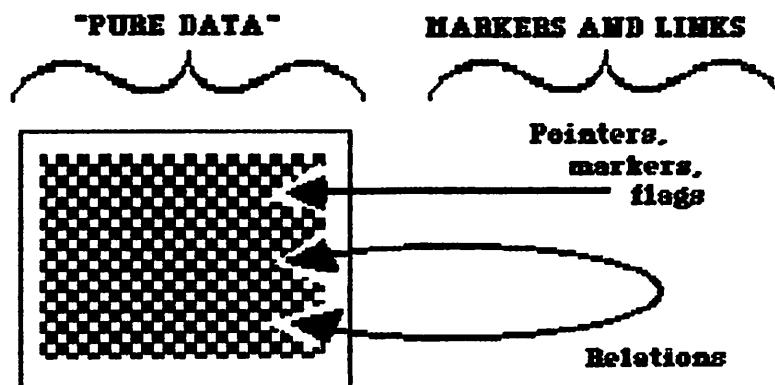
MARKERS AND LINKS

We want to mark and link data for many purposes. You may use markers to point at specific items, to hold your place, to indicate items or sections of a certain type.

You may also want links between different parts of your data-- to show comments; to show structural interconnections; to show corresponding parts (e.g. between code and documentation); and so on.

We want to move markers and links out of the data, but keep them where different users can use them for different purposes. All the different types of links and markers are to be kept in a separate pool.

This is DATAlinks.D10



These markers and links may be of many types, but by pooling them we gain

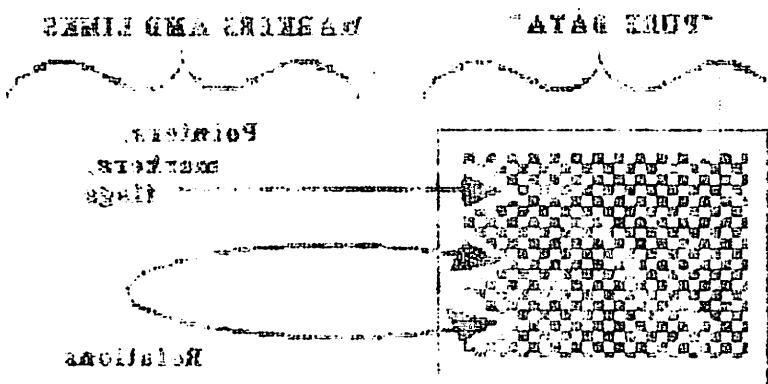
and to be established as a part of their van der
metre's parboil system.

MILK AND DAIRY

reaching him not with stiff hands but with a
gentle smile, the dining room was now
so quiet, so still, so peaceful, so quiet, that
I could hardly believe it to be alive.

the benefits received will have the same value
made of permissible value or less but not to
value of permissible value or less but not to
the value of permissible value or less but not to
the value of permissible value or less but not to

TYPE IN THE DATE/NAME/ID

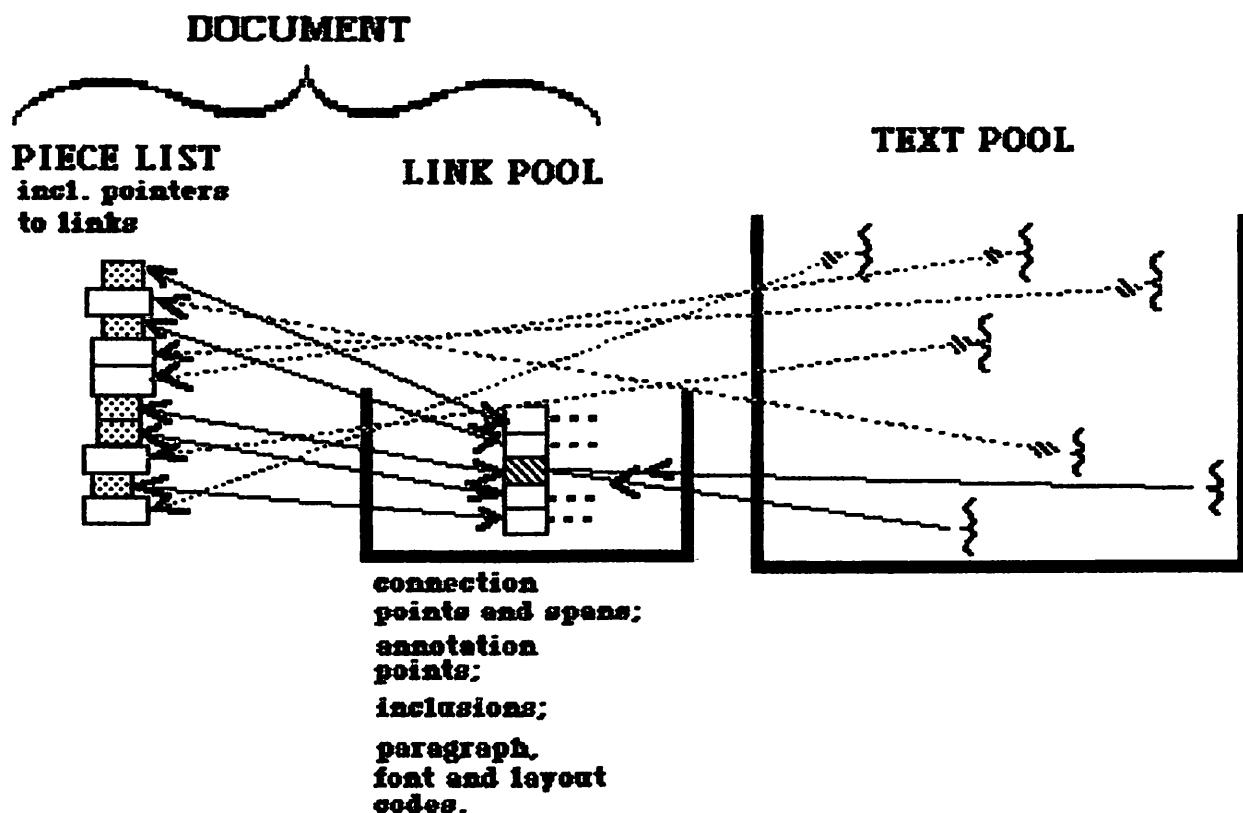


numerous advantages: we can find which ones attach to any given section of data; we can search them by type, by time of entry, by owner and so on.

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Let's consider how this will work in a text system-- a text system for the storage and maintenance of linked materials (hypertext) and arbitrary forms of annotation.

This is LINKPOOL.D10



Each document can be read in sequence; every use of a piece can be traced to the other documents it has migrated to; and overlapping pieces can be coded in numerous ways-- without obstructing uses that don't need them.

TRICKY APPLICATIONS

What we call here "links" are easily used for database-type coding. Thus that this data structure easily supports the application described earlier-- coding parts of documents and searching for them so they may be seen in their living document contexts. (Neither word

sqn. 1d mark. Please let me know if the following design cons.
ists of two pieces or one.

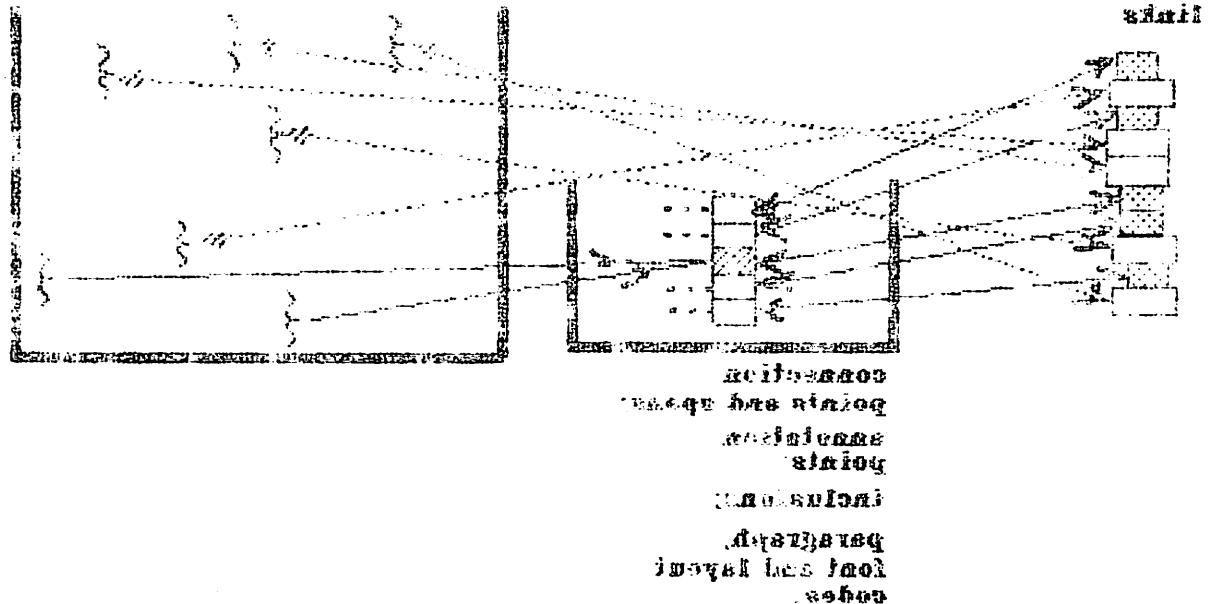
that a lot more effort and more extensive analyses especially will not mistake what is unique (and therefore distinctive) about the conservatism and illusions to amoral individualism.

015.2003ИП № 145

THEMUDOU

1009 ТХНТ

100% जमीन



new names; penances will be set up and punishments imposed
and rewards given to those who bring in new species to
the zoological gardens; and the best of these will be
given gold medals.

1996-1997-1998-1999

processing nor database has advantage to the programmer over their combination.)

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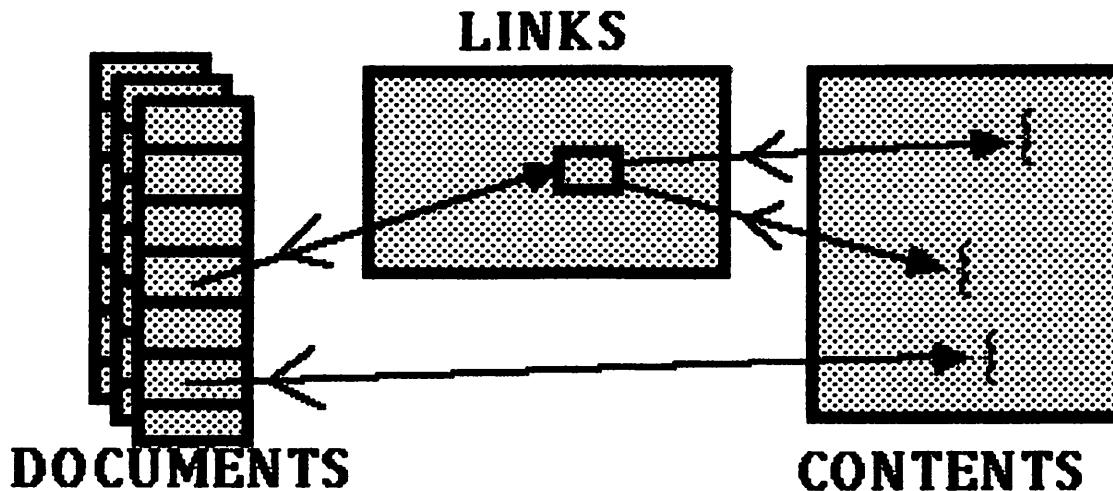
Indeed, this style of data structure exerts no pressure to design applications a given way; and so escapes the styles of problem analysis, and divisions into simplified solutions, that are fostered by conventional files.

GENERALIZED STORAGE

This notion generalizes to a new storage paradigm with wide-ranging implications. I believe it is a unification which can exactly represent the intrinsic structure of all data.

This is GNRLSTOR.D8

Generalized Storage:



Though it is not generally recognized, this is needed in ALL FIELDS AND APPLICATIONS. Engineering, law, medicine, computer science, art history, entomology and intelligence work have the same problems of representing linkage and origins of data, commonality between documents, historical backtrack. This is true for all types of data-- text, graphics, business data, scientific data.

OFFICE AUTOMATION

And there is no way to have the automated office without it. Without these facilities, I submit, there is no way to build the kinds of features that the true paperless office will require, eliminating the debris of loose and lost files that are accumulating everywhere.

generalized storage

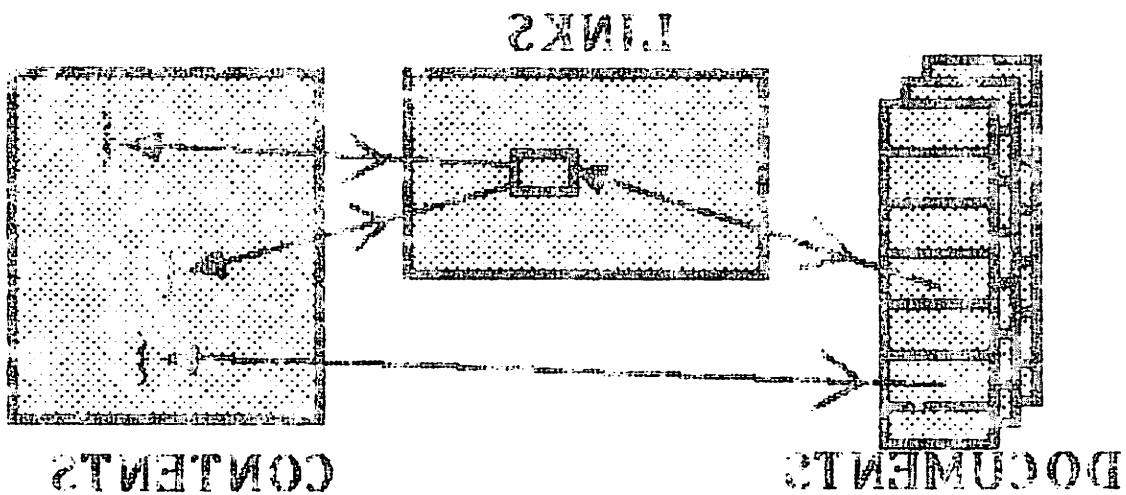
on a more granular level, this is achieved by using a linked list structure. In this structure, each node contains a pointer to the next node in the list, and a value. This allows for efficient insertion and deletion of nodes from the list.

GENERALIZED STORAGE

This is a more general form of storage, allowing for the storage of any type of data. It is implemented using a linked list structure, where each node contains a pointer to the next node in the list, and a value. This allows for efficient insertion and deletion of nodes from the list.

TYPE OF STORE: DOCUMENTS

DOCUMENTS STORE



This diagram illustrates a linked list structure for document storage. It features three main components: 'LINKS' (represented by a stack of three rectangles), 'DOCUMENTS' (represented by a stack of three rectangles), and 'DOCUMENTS' (represented by a stack of three rectangles). Arrows indicate the flow of data: an arrow from 'LINKS' to 'DOCUMENTS' indicates the storage of links, and an arrow from 'DOCUMENTS' to 'LINKS' indicates the retrieval of links.

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PUBLISHING

On-line publishing so far has sold chunks of text that are too big. Users need to be able to browse on-line through forests of interconnected material, paying for small pieces as they go. The approach we have described is excellent for on-line publication with royalty, since everything's origin is identifiable down to the byte level.

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When a document is read out by a user, the owner of each byte may be minutely rewarded from the user's account with no intricate mechanism-- just as the user of a jukebox automatically pays royalties to a song's owner and performer.

We may even envision A NEW LITERATURE-- where linkage, intrinsic everywhere, becomes now a part of the structure of the writing itself.

ARCHIVING

The problem of digital archives is growing at an extraordinary pace. There is an increasing chaos of different programs and formats.

It is not known whether the software used to produce some of these data will even continue to exist, let alone be maintained, when historians want to study the material-- let alone next year, when the boss wants to find out what happened.

There are word processors and spreadsheets of every conceivable kind, there are forests of graphics and 3D shapes produced by a variety of systems, and much more. The increasing need for archival storage demands that a universal archival form be found-- one to which all existing data structures and arrangements may be mapped.

What we need is a stable and generalized form of storage on which persons of good will can agree, leaving out nothing which is represented in any other system. And I believe this can be achieved.

EXPANSION

Separate installations have their limits. We need a stable indexing scheme that works across node boundaries, if we are to have an indefinitely expansible network OF instantaneous accessibility. And that is what must be.

PUBLISHING

to give a clear and simple answer to the question of whether the new system will be effective in reducing the incidence of the disease.

When a company is new, it may be best to keep its focus on the market needs of its customers and to develop a strategy that emphasizes the unique needs of its target market. This can be done by identifying the specific needs of the market and developing products and services that meet those needs. It can also be done by identifying the unique needs of the market and developing products and services that meet those needs.

the max shear stresses in a NEW LITTERATURE - where
Linnkade, Ingmaric shear stresses down a
shear to the magnitude of the friction coefficient

ЗИГВІНДЯ

as the government as a sovereign entity to itself, and the
government as a sovereign entity to the people.

at been ensured will depend upon whether or not the
of units has been fully satisfied to those requirements
ensuring that the institution is not only a safe, reliable
fixed assets but also satisfies all requirements of the
state for the unit of education and its welfare, especially
the educational

To most best-known bus systems is as been as follows:
usage and how long the average vehicle is expected
to be in service and doing what the vehicles
are used for and the bus system.

EXERCISE